

CLAIMS:

WE CLAIM AS OUR INVENTION:

1. A system to measure a gas flow rate for a gas provided by a mass flow controller to a process chamber via a process line, comprising:

- a. said mass flow controller;
- b. a vent line fluidly connecting to said process line between said mass flow controller and said process chamber, said vent line comprising
  - i. a bypass loop having an inlet junction and a return junction fluidly connecting said bypass loop to said vent line, and comprising
    - a. a flow detector for measurement of a gas flow flowing through said bypass loop;
    - b. a first bypass control valve between said inlet junction and said flow detector;
  - ii. a main vent line shut-off valve between said inlet junction and said return junction; and
- c. a computational control device that receives data signals from said flow detector;

whereby said gas flow directed through said bypass loop provides a measurement of said mass flow controller's gas flow rate which provides information for quantitation or for calibration of said mass flow controller.

2. The system of claim 1, wherein said flow detector is a digital mass flow controller.

3. The system of claim 1, wherein said bypass loop additionally comprises a second bypass control valve between said flow detector and said return junction.

4. The system of claim 1, additionally comprising a process line shut-off valve positioned between a junction between said vent line and said process chamber,

wherein closing said process line shut-off valve directs all gas from said mass flow controller to said vent line.

5. The system of claim 1, additionally comprising a manifold fluidly connecting two or more mass flow controllers to said vent line, whereby valving control of the manifold provides gas from any one of said two or more mass flow controllers to said vent line for said measurement.

6. The system of claim 1, additionally comprising a process line shut-off valve positioned between a junction between said vent line and said process chamber, wherein closing said process line shut-off valve directs all gas from said mass flow controller to said vent line, and wherein said bypass loop additionally comprises a second bypass control valve between said flow detector and said return junction

7. The system of claim 1, additionally comprising a back pressure or a back vacuum compensating system to provide a back pressure or a back vacuum to the flow detector in the bypass loop that is representative of the back pressure or back vacuum existing the said process chamber during use of said gas.

8. A system to measure a gas flow rate for a gas provided by a mass flow controller to a process chamber via a process line, comprising:  
said mass flow controller;

a bypass loop fluidly connecting to said process line between said mass flow controller and said process chamber, said bypass loop comprising an inlet junction and a return junction fluidly connecting said bypass loop to said process line, and comprising

a flow detector for measurement of a gas flow flowing through said bypass loop;  
a first bypass control valve between said inlet junction and said flow detector;  
a process line shut-off valve between said inlet junction and said return junction;

and

a computational control device that receives data signals from said flow detector;

whereby said gas flow directed through said bypass loop provides a measurement of said mass flow controller's gas flow rate which provides information for quantitation or for calibration of said mass flow controller.

9. The system of claim 8, wherein said flow detector is a digital mass flow controller.

10. The system of claim 8, wherein said bypass loop additionally comprises a second bypass control valve between said flow detector and said return junction.

11. The system of claim 8, wherein said bypass loop additionally comprises a pressure release valve between said flow detector and said return junction.

12. The system of claim 8, additionally comprising a first manifold fluidly connecting two or more process lines to said process chamber, whereby valving control of the manifold provides gas from any one of said two or more mass flow controllers to said bypass loop for said measurement.

13. The system of claim 8, additionally comprising a second manifold fluidly connecting two or more process lines to said process chamber, whereby valving control of the manifold returns gas from said bypass loop to said process chamber.

14. A system to measure a gas flow rate for a gas provided by a dedicated means for metering a gas to a process chamber via a process line, comprising:

said dedicated means for metering;

a line fluidly connecting to said process line between said mass flow controller and said process chamber, said line beginning at an inlet junction and comprising

a first means to control said gas flow, located between said inlet junction and said means for measuring; and

a means for measuring a gas flow flowing through said line;

a means to direct gas flow through either the process line or the line in "b" above;  
and

a computational control device that receives data signals from said means for measuring a gas flow;

whereby said gas flow directed through said line in "b" above provides a measurement of said flow rate of gas through said dedicated means for metering which provides information for quantitation or for calibration of said dedicated means for metering.

15. The system of claim 14, wherein said measurement is repeated over time and is used to quantify the gas flow passing through said dedicated means for measuring.

16. The system of claim 14, additionally comprising at least one additional dedicated means for metering at least one additional gas.

17. The system of claim 16, wherein a comparison between set and measured flow rates of two or more of said dedicated means for metering, by said means for measuring a gas flow flowing through said line, provides a correction factor for said means for measuring a gas flow flowing through said line.

18. A method to calibrate a flow of gas to a process chamber that is set by a mass flow controller, comprising the steps of:

setting the mass flow controller to a specific gas flow rate;

adjusting valves to direct a calibrating gas flow from said mass flow controller through a vent line and into a bypass loop in fluid communication with said vent line by means of an inlet junction and a return junction, said bypass loop also comprising a flow detector for measurement of said calibrating gas flow flowing through said bypass loop; measuring a bypass loop gas flow rate of said calibrating gas flow with said flow detector;

comparing said bypass loop gas flow rate to said desired gas flow rate; and

calculating a relationship between said bypass loop gas flow rate and said desired gas flow rate whereby said relationship provides information to quantitate or to calibrate said mass flow controller, or to replace or to repair said mass flow controller.

19. A method to calibrate a flow of gas to a process chamber that is set by a mass flow controller, comprising the steps of:

setting the mass flow controller to a specific gas flow rate;

adjusting valves to direct a calibrating gas flow from said mass flow controller into a bypass loop in fluid communication with a process line by means of an inlet junction and a return junction, said bypass loop also comprising a flow detector for measurement of said calibrating gas flow flowing through said bypass loop;

measuring a bypass loop gas flow rate of said calibrating gas flow with said flow detector;

comparing said bypass loop gas flow rate to said desired gas flow rate; and

calculating a relationship between said bypass loop gas flow rate and said desired gas flow rate wherein said process line is in fluid communication with said process chamber and with said mass flow controller, and whereby said relationship provides information to quantitate or to calibrate said mass flow controller, or to replace or to repair said mass flow controller.